

## Description

# Hydraulic Piston Locking Device

### BACKGROUND OF INVENTION

[0001] Field of the invention

[0002] This invention relates, generally, to anti-theft devices. More particularly, it relates to a device that locks an extended hydraulic cylinder so that it cannot move.

[0003] Description of the prior art

[0004] Heavy machinery such as such as loaders, backhoes, skid steer loaders, crawlers, graders, articulated loaders, trenchers, dozers, and the like are typically parked on the job site throughout the course of a construction project because the effort to transport the equipment to a secure site is expensive and time-consuming. The machinery is susceptible to theft and vandalism.

[0005] Equipment theft from construction sites is a significant problem. The machinery is expensive to replace if stolen.

[0006] Devices that lock steering wheels offer little protection because such devices are easily cut off with a hacksaw or

other suitable cutting tool. Other locking devices can be burned or pried off.

[0007] What is needed, then, is a locking device that is highly resistant to sawing, burning, or prying.

[0008] Buckets, blades and other attachments of heavy machinery commonly include hydraulic cylinder and piston rod assemblies. Hydraulic pressure is harnessed to retract and extend a piston rod from a hydraulic cylinder.

[0009] A steel sleeve is commonly interposed between the connection point, or bearing, at the distal end of the piston rod and the cylinder. The steel sleeve prevents retraction of the piston rod in the event of loss of hydraulic pressure, thereby preventing unintended movement of the attachment.

[0010] A steel sleeve can also be used as a locking device by placing it over the exposed piston rod. A padlock is typically employed to lock the sleeve. This prevents the sleeve from being removed and thus secures the piston rod in an extended condition.

[0011] With the rod in an extended position the attachments are secured in either a lowered or raised position, thereby hindering unauthorized movement of the heavy machinery.

- [0012] Prior art hydraulic locking devices include U.S. patent No. 4,373,851 to Confoey that discloses a split cylindrical sleeve that encloses around the piston rod and includes extended tabs that are locked together using a padlock to prevent removal. The Confoey configuration is susceptible to having the padlock cut off using bolt cutters or broken off using extreme force.
- [0013] An improved locking device that is easy to install and remove, which is durable, and which protects against theft and vandalism is needed.
- [0014] However, in view of the prior art considered as a whole at the time the present invention was made, it was not obvious to those of ordinary skill in the pertinent art how the identified needs could be fulfilled.

#### **SUMMARY OF INVENTION**

- [0015] The long-standing but heretofore unfulfilled need for a locking device for heavy machinery that can be used at unsecured construction sites or storage areas, which can be installed and removed easily, and which is durable, is now provided in the form of a new, useful and non-obvious device.
- [0016] The novel structure includes a substantially rigid, hollow sleeve made of two generally symmetrical, elongate parts

that are hingedly connected to one another.

[0017] Each sleeve part is channel-shaped in transverse cross-section and has a proximal end, a distal end, a top wall, a side wall, and a bottom wall. The bottom wall of each sleeve part has a breadth less than the breadth of the top wall. Accordingly, when a first sleeve part is disposed in confronting relation to a second sleeve part, the top walls of said first and second sleeve parts abut one another and the bottom walls are spaced apart from one another.

[0018] The post of an elongate hinge member is positioned in the elongate space between said bottom walls and substantially occupies said space.

[0019] The elongate hinge is of conventional construction but is discontinuous mid-length of the hollow sleeve. Thus a first and a second part of the hinge are in axial alignment with one another but are longitudinally spaced apart from one another. The space between the first and second hinge parts is provided to accommodate a second or auxiliary sleeve-locking means that backs up a primary sleeve-locking means.

[0020] Each part of the hinge includes a first plurality of equidistantly and longitudinally spaced apart cylindrical inboard parts that slidingly, rotatingly, and collectively receive a

hinge post. A first flat plate outboard part formed integrally with said inboard parts is fixedly secured to a bottom wall of the first sleeve part in overlying relation thereto.

[0021] Each part of the hinge includes a second plurality of equidistantly and longitudinally spaced apart cylindrical inboard parts that are interleaved with and in axial alignment with the first plurality of cylindrical inboard parts and which also collectively receive said hinge post. A second flat plate outboard part formed integrally with said second plurality of cylindrical inboard parts is fixedly secured to a bottom wall of the second sleeve part in overlying relation thereto.

[0022] The second part of the hinge has the same construction.

[0023] The first and second sleeve parts are thus hingedly connected to one another along their respective bottom walls. When the hinge is fully closed, the respective edges of the top walls of the first and second sleeve parts abut one another and the assembly is adapted to form an enclosure about an extended hydraulic piston rod.

[0024] A half flange is formed at the proximal end of each sleeve part so that when the hinge is fully closed, a full flange is formed at said proximal end. The flange abuts the distal

end of a hydraulic cylinder.

[0025] A first reinforcing band is fixedly secured to the distal end of the first sleeve part. The distal edge of said first reinforcing band is flush with the distal end of said first sleeve part.

[0026] A second reinforcing band is fixedly secured to the distal end of the second sleeve part. The distal edge of said second reinforcing band is flush with the distal end of said second sleeve part.

[0027] The first and second reinforcing bands perform the function of dissipating stress loads concentrated at the respective distal ends of said first and second sleeve parts.

[0028] A first centrally apertured lock lug is secured to or formed integrally with the first sleeve part, mid-length thereof, in upstanding relation relative to said top wall of said first sleeve part. Said first lock lug is positioned on the inboard edge of said first sleeve part top wall.

[0029] A second centrally apertured lock lug is secured to or formed integrally with the second sleeve part, mid-length thereof, in upstanding relation relative to said top wall of said second sleeve part. Said second lock lug is positioned on the inboard edge of said second sleeve part top wall, in confronting relation to said first lock lug. The respective

apertures formed in said first and second lock lugs are therefore in alignment with one another.

[0030] A first semicircular wall of uniform height is mounted to said first top wall, mid-length thereof and in upstanding relation thereto, in half-encircling relation to said first lock lug.

[0031] A second semicircular wall of non-uniform height is mounted to said second top wall, mid-length thereof and in upstanding relation thereto, in half-encircling relation to said second lock lug. A semicircular cut-away is formed in an outboard end of said second semicircular wall. The cut-away is formed in the bight region of said second semicircular wall and provides a clearance space.

[0032] The first lock lug integral with the first sleeve part and the second lock lug integral with the second sleeve part are secured to one another by a commercially available shackleless locking means with a hidden pin assembly or other suitable locking means.

[0033] A second locking means is formed in the novel apparatus on the opposite, bottom side thereof. A first transversely disposed, centrally apertured lock lug is secured to or formed integrally with the bottom wall of the first sleeve part, mid-length thereof. A plane that longitudinally bi-

sects the apparatus into the first sleeve part and the second sleeve part bisects the first bottom wall lock lug.

[0034] Similarly, a second transversely disposed, centrally apertured lock lug is secured to or formed integrally with the bottom wall of the second sleeve part, mid-length thereof. Said plane also bisects said second bottom wall lock lug.

[0035] A first transversely extending slot is formed in the second sleeve part to accommodate the first bottom lock lug when the hollow sleeve is swung open about its hinge, and a second transversely extending slot is formed in the first sleeve part to accommodate the second bottom lock lug when said hollow sleeve is swung open about said hinge.

[0036] A shackleless locking means with a hidden pin assembly or other suitable locking means is employed to join the first and second bottom lock lugs together by extending the pin of a shackleless locking means through the confronting central apertures formed in said first and second bottom lock lugs. The bottom lock may also be secured by extending the shackles of a conventional lock having shackles through said confronting apertures.

[0037] In this way, the hollow sleeve is locked with two opposed



locking means, both of which must be defeated before the hollow sleeve may be swung open about said elongate hinge.

[0038] An important object of the present invention is to provide an improved locking device for use with heavy machinery that prevents the movement of a hydraulic piston rod and thus prevents the theft of the machinery.

[0039] Another object is to provide a means for attaching the locking device in a proper, functional location without undue effort so that the locking device may be easily installed and removed as needed.

[0040] Another object is to provide a locking device suitable for several different heavy machines without modification.

[0041] Another object is to provide a durable locking device that and can withstand multiple unauthorized removal attempts.

[0042] These and other important objects, advantages, and features of the invention will become clear as this description proceeds.

[0043] It is to be understood that both the foregoing general description and the following detailed description are explanatory and are not restrictive of the invention as claimed. The accompanying drawings, which are incorpo-

rated in and constitute part of the specification, illustrate embodiments of the present invention and together with the general description, serve to explain principles of the present invention.

[0044] The invention accordingly comprises the features of construction, combination of elements, and arrangement of parts that will be exemplified in the description set forth hereinafter and the scope of the invention will be indicated in the claims.

#### **BRIEF DESCRIPTION OF DRAWINGS**

[0045] For a fuller understanding of the nature and objects of the invention, reference should be made to the following detailed description, taken in connection with the accompanying drawings, in which:

[0046] Fig. 1 is a perspective view of the novel locking device in its fully closed and locked configuration position;

[0047] Fig. 2 is a top plan view thereof;

[0048] Fig. 3 is top view thereof when in an unlocked and open configuration;

[0049] Fig. 4 is a detailed side elevational view thereof;

[0050] Fig. 5 is a side elevational view of the novel locking apparatus when in its fully closed and locked configuration;

- [0051] Fig. 6 is a rear elevational view thereof when in its fully closed and locked configuration;
- [0052] Fig. 7 is a sectional view taken along line 7-7 in Fig. 6;
- [0053] Fig. 8 is a view like Fig. 7 but depicting the novel locking apparatus in an open configuration;
- [0054] Fig. 9 is a side elevational view depicting the novel locking apparatus when positioned in operative relation to a backhoe equipped tractor; and
- [0055] Fig. 10 is front view of the novel locking apparatus when positioned in operative relation to a bulldozer.

#### **DETAILED DESCRIPTION**

- [0056] Referring now to Figs. 1 and 2, it will there be seen that the reference numeral 10 denotes the novel locking device as a whole. Device 10 will be known commercially as the SleeveLock™ theft-deterrent apparatus or locking device.
- [0057] Locking device 10 includes first sleeve part 12 and second sleeve part 14. Each of said sleeve parts is channel shaped so that when said parts are positioned in confronting relation to one another, they collectively form a hollow sleeve. Although both sleeve parts are depicted as having a generally square "U" shape in transverse cross-section so that they collectively form an elongate square sleeve when dis-

posed in confronting relation to one another, each of said sleeve parts could also have a semi-circular shape in transverse cross-section so that they collectively form a cylinder when so disposed. Nor is the invention limited to hollow sleeves of square or cylindrical cross-section; a machine designer of ordinary skill may select numerous other operable shapes and all such other shapes are within the scope of this invention.

[0058] As best understood in connection with Figs. 3 and 6, longitudinally extending hinge members 16a and 16b hingedly interconnect first sleeve part 12 and second sleeve part 14 to one another. Said hinge members are in axial alignment with one another but are discontinuous relative to one another as best depicted in Fig. 6.

[0059] Hinges 16a and 16b have a common, conventional construction including a first and a second plurality of equidistantly and longitudinally spaced apart, axially aligned, interleaved cylindrical inboard parts that slidably, rotatingly, and collectively receive a common hinge post in a well-known way.

[0060] More particularly, hinge 16a includes a first flat outboard plate 17a formed integrally with said first plurality of cylindrical inboard parts. Flat plate 17a is fixedly secured

to an interior surface of bottom wall 12b of first sleeve 12 part in overlying relation thereto as perhaps best depicted in Figs. 7 and 8.

[0061] Hinge 16a further includes a second flat outboard plate 17b formed integrally with said second plurality of cylindrical inboard parts. Flat plate 17b is fixedly secured to an interior surface of bottom wall 14b of second sleeve part 14 in overlying relation thereto also as depicted in Figs. 7 and 8.

[0062] Hinge 16b has the same construction as aforesaid.

[0063] The longitudinally extending space occupied at least in part by hinge members 16a and 16b is created because top wall 12a of sleeve part 12 and top wall 14a of sleeve part 14 have a greater transverse extent than bottom wall 12b of sleeve part 12 and bottom wall 14b of sleeve part 14, as perhaps best understood in connection with Fig. 7. When novel locking device 10 is in its fully closed configuration, the confronting edges of top walls 12a and 14a abut one another and the confronting edges of bottom walls 12b, 14b are spaced apart from one another by a space sufficient to receive said elongate hinge members 16a and 16b.

[0064] Half flange 18 is formed at the proximal end of sleeve

part 12 and half flange 20 is formed at the proximal end of sleeve part 14 so that when the hinge is fully closed, a full flange 22 is formed at said proximal end as depicted in Fig. 1. Flange 22 abuts the distal end of a hydraulic cylinder when the novel locking device is in use.

[0065] First reinforcing band 24 is fixedly secured to the distal end of first sleeve part 12. The distal edge of said first reinforcing band is flush with the distal end of said first sleeve part.

[0066] Second reinforcing band 26 is fixedly secured to the distal end of second sleeve part 14. The distal edge of said second reinforcing band is flush with the distal end of said second sleeve part.

[0067] First and second reinforcing bands 24 and 26 perform the function of dissipating stress loads concentrated at the respective distal ends of said first and second sleeve parts, *i.e.*, the interface between locking means 10 and the load-bearing region where the hydraulic cylinder bears against the part or parts controlled thereby.

[0068] First centrally apertured lock lug 28 is secured to or formed integrally with first sleeve part 12, mid-length thereof, in upstanding relation relative to top wall 12a on the inboard edge of said top wall 12a.

[0069] Second centrally apertured lock lug 30 is secured to or formed integrally with second sleeve part 14, mid-length thereof, in upstanding relation relative to top wall 14a on the inboard edge of said top wall 14a, in confronting relation to first lock lug 28 when locking device 10 is in its fully closed configuration. The respective central apertures formed in said first and second lock lugs, which are depicted but unnumbered to avoid cluttering the drawings, are in cooperative alignment with one another when said locking device is in said fully closed configuration.

[0070] First semicircular wall 32 of uniform height is mounted to top wall 12a, mid-length thereof and in upstanding relation thereto, in half-encircling relation to first lock lug 28.

[0071] Second semicircular wall 34 of non-uniform height is mounted to second top wall 14a, mid-length thereof and in upstanding relation thereto, in half-encircling relation to second lock lug. 30 A semicircular cut-away 36 is formed in the bight region of said second semicircular wall and provides a clearance space so that a key, not shown, may access keyhole 38 (Fig. 4) to enable an authorized user to lock and unlock shackleless locking member 40 (also depicted in Fig. 4).

[0072] It should be understood that shackleless locking member

40 includes a hidden pin that extends through the central apertures formed in first and second lock lugs 28, 30 when said lock lugs are in confronting relation to one another, *i.e.*, when locking device 10 is in its fully closed configuration.

[0073] A plurality of resilient pads, collectively denoted 42, are positioned within each sleeve part 12, 14, at opposite ends thereof to protect an extended hydraulic piston rod from damage and to provide a secure fit of locking device 10 around said piston rod when the locking device is in its fully closed and locked configuration.

[0074] A second locking means is formed in novel locking device 10 on the opposite, bottom side thereof.

[0075] Said second locking means includes a first centrally apertured lock lug 44 secured to or formed integrally with bottom wall 12b of first sleeve part 12, mid-length thereof and a second centrally apertured lock lug 46 secured to or formed integrally with bottom wall 14b of second sleeve part 14, mid-length thereof.

[0076] As perhaps best understood in Fig. 4, first and second lock lugs 44 and 46 are disposed in parallel, confronting relation to one another when locking device 10 is in its fully closed configuration. Both of said lock lugs are dis-



posed transversely to a longitudinal axis of locking device 10.

[0077] First transversely extending slot 44a formed in second sleeve part 14 to accommodate first bottom lock lug 44 when hollow sleeve 10 is swung open about its hinge. Second transversely extending slot 46a is formed in first sleeve part 12 to accommodate second bottom lock lug 46 when said hollow sleeve is swung open about said hinge.

[0078] Shackleless locking means 40a having keyhole 38a and a hidden pin (Fig. 5) is employed to join first and second bottom lock lugs 44, 46 together by extending the pin through the confronting central apertures formed in said first and second bottom lock lugs. The bottom lock may also be secured by extending the shackles of a conventional lock having shackles through said confronting apertures.

[0079] Fig. 9 depicts locking device 10 installed on tractor 50 having backhoe attachment 52 that includes a pair of booms 54, 56 and a bucket 58 pivotally connected to one another. Boom 56 is under the control of hydraulic piston and cylinder assembly 60. Piston rod 62 of first boom 56 is shown in an extended position and device 10 is de-

picted in a closed and locked position encircling said piston rod 62. Flange 22 is disposed in abutting relation to hydraulic cylinder 60 and has a diameter greater than said hydraulic cylinder 60 where the opposing end of locking device 10 abuts boom 54. Thus, any hydraulic force generated by an attempt to retract piston rod 62 into cylinder 60 when locking device 10 is installed is distributed to the outer cylinder wall thereby decreasing the potential for damage to the mechanical capabilities of attachment 52 during a theft or vandalism attempt.

[0080] With locking device 10 in place, boom 54 and bucket 58 cannot be raised from the ground and tractor 10 cannot be moved.

[0081] A second locking device may be installed on hydraulic piston and cylinder assembly 70 if desired for additional security protection. However, placing locking device 10 solely on second piston rod 72 would not provide the desired security protection to prevent bucket 58 from being raised.

[0082] Fig. 10 partially depicts bulldozer 80 having blade attachment 82. Blade 82 is pivotally attached to bulldozer 80 and is under the control of hydraulic piston and cylinder assembly 84. Piston rod 86 of cylinder 84 is in an ex-

tended position and device 10 is depicted in its fully closed and locked position encircling rod 86. Annular flange 22 is disposed in abutting relation to cylinder 84 and has a diameter greater than cylinder 84 where the opposing end of locking device 10 abuts blade 82. Similar to backhoe attachment 52 depicted in Fig. 9, any hydraulic force generated by an attempt to retract piston rod 86 into cylinder 84 is distributed to the outer cylinder wall thus decreasing the potential for damage to the mechanical capabilities of blade 82 during a theft or vandalism attempt.

[0083] Accordingly, when locking device 10 is in its functional configuration, blade 82 cannot be raised from the ground and bulldozer 80 cannot be moved.

[0084] The locking device is easily installed and is easily removed by authorized personnel. The locking device is durable and withstands multiple unauthorized removal attempts. It is suitable for use with any heavy machine having a hydraulic cylinder. Moreover, locking device can be manufactured to any desired length or diameter to fit hydraulic cylinders of differing sizes.

[0085] It will thus be seen that the objects set forth above, and those made apparent from the foregoing description, are

efficiently attained. Since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matters contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

[0086] It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention that, as a matter of language, might be said to fall therebetween.

[0087] Now that the invention has been described,